

## Title

### **SELF-ORIENTATING PUMP NOZZLE FOR FLUID DISPENSER**

## Scope of the Invention

**[0001]** This invention relates to fluid dispensers and, more particularly, to a fluid dispenser with a nozzle which is self-orientating to direct fluid in the desired direction with insertion of a pump carrying the nozzle into a dispenser.

## Background of the Invention

**[0002]** Fluid dispensers such as disclosed in U.S. Patent 5,431,309 issued July 11, 1995 are known in which a liquid to be dispensed is contained in a disposable container which incorporates a pump assembly. Typically, the pump assembly includes a reciprocally movable piston which, when moved, dispenses a quantity of liquid from the container. The containers are fitted within a permanent dispenser housing which includes a movable actuator assembly which secures and reciprocally moves the movable element to dispense the fluid. Once the fluid in the disposable container has been exhausted, the disposable container is replaced by another disposable container incorporating an identical pump assembly.

**[0003]** U.S. Patent 5,431,309 provides a construction which permits simplified replacement of a fluid container incorporating a pump assembly with a piston movable between extended and retracted positions. The patent provides an arrangement whereby whether the piston is in an extended or a retracted position, after insertion of the container into the permanent housing, cycling of the movable actuator assembly secures the piston in a desired coupled arrangement with the movable actuator assembly. The patent provides that when inserted such that the piston may not initially be in the desired coupled arrangement that after an initial cycling of the movable actuator assembly, the piston comes to be properly coupled.

**[0004]** Liquid dispensers such as the type illustrated in U.S. Patent 5,431,304 are known as adapted for dispensing a wide variety of fluids including fluids of relatively low viscosity

such as water-like fluids, aqueous alcohol solutions and alcohol and in which a nozzle is provided at the end of the pump so as to provide a spray pump which emits an atomized cone of the liquid onto a user's hand. The present applicant has appreciated disadvantages with such spray pumps in that the atomized cone of the liquid being dispensed may be directed in directions which are not desired. For example, a cone of spray may spray liquid onto a wall on which the dispenser is mounted or onto a movable actuator, typically a presser bar, which is manually moved to dispense the liquid. This has been appreciated to cause a liquid build up on the wall or presser bar which can be messy and can drip off after use. This has a disadvantage that the dripping can cause a user to assume that the dispenser is leaking. As well, the dripping is messy and can cause unsightly build up on a surface onto which the liquid is sprayed or dripped and, as well, can cause slippery conditions if the liquid drips onto a floor surface.

#### Summary of the Invention

**[0005]** To at least partially overcome these disadvantages of known fluid dispenser, the present invention provides a replaceable fluid container carrying a spray pump with a nozzle which directs spray directionally in which an arrangement is provided for orientating the nozzle into a desired orientation on insertion of the container into a dispenser. In a preferred aspect of the invention, with replacement of the disposable container into a permanent housing, the spray pump and its nozzle will automatically be self-orientating.

**[0006]** An object of the present invention is to provide an improved fluid dispenser with a spray pump having a nozzle which restricts the relative sector into which fluid is sprayed relative to the dispenser.

**[0007]** Another object is to provide a replaceable pump with a nozzle which is adapted to be disposed in preferred orientations relative to a permanent housing and in which interaction between the pump and the permanent housing renders, on insertion of the pump into the permanent housing, for the nozzle to adopt a preferred orientation.

### Brief Description of the Drawings

**[0008]** Further aspects and advantages of the invention will appear from the following description taken together with the accompanying drawings in which:

**[0009]** Figure 1 is an exploded partial perspective view of a preferred embodiment of a housing and reservoir in accordance with the invention with the housing open for reservoir insertion;

**[0010]** Figure 2 is a partial cross sectional view of the preferred embodiment of the housing and reservoir of Figure 1 with the housing closed in a coupled first orientation with the actuator assembly and the reciprocally movable piston element in an extended position;

**[0011]** Figure 3 is a partial perspective view of the reservoir and housing of Figure 1 with the housing closed in a coupled first orientation with the activator assembly and piston element in a retracted position;

**[0012]** Figures 4 and 5 show partial perspective views of the housing and reservoir of Figure 1 with the housing closed in respective uncoupled second and third orientations and with the actuator assembly and piston element in the extended position;

**[0013]** Figure 6 is a pictorial view showing the reservoir of Figure 1 with its valve assembly and piston extending from the reservoir;

**[0014]** Figure 7 is a pictorial view of the piston shown in Figure 2 but cross-sectioned at section line 7-7' in Figure 2;

**[0015]** Figure 8 is a cross-sectional plan view of merely the piston along section line 8-8' in Figure 7;

**[0016]** Figure 9 is a partial cross-sectional view of the piston engagement flange and the catch assembly taken in horizontal plane 9-9' of Figure 5 with the piston element in a desired rotational position;

**[0017]** Figure 10 is a view similar to Figure 9 in the plane of section line 9-9' in Figure 2 but showing the piston engagement flange as it is slid rearwardly in insertion and first engages the catch assembly;

**[0018]** Figures 11, 12 and 13 are each views similar to Figure 9 in the plane of section line 9-9' in Figure 2 but showing successive relative positions of the piston engagement

flange as it is slid rearwardly in insertion from the positions of Figure 11 to Figure 12 to Figure 13;

**[0019]** Figure 14 is a view similar to Figure 9 in the plane of section line 9-9' in Figure 2 but showing the piston engagement flange as it is slid rearwardly in insertion and first engages the catch assembly;

**[0020]** Figures 15 and 16 are each views similar to Figure 9 in the plane of section line 9-9' in Figure 2 but showing successive relative positions of the piston engagement flange as it is slid rearwardly in insertion from the position of Figure 15 to that of Figure 16;

**[0021]** Figure 17 is a partially exploded pictorial view of a second preferred embodiment of a housing and reservoir in accordance with the invention;

**[0022]** Figure 18 is a schematic partial pictorial view of the dispenser of Figure 17 showing spray patterns;

**[0023]** Figure 19 is a pictorial view of the actuator assembly of the dispenser of Figure 17;

**[0024]** Figures 20, 21 and 22 are pictorial views of the actuator of Figure 19 showing the piston element of the reservoir as being inserted and assuming positions similar to that illustrated in Figure 15, Figure 16, in Figures 20 and 21, respectively;

**[0025]** Figure 23 is a cross-sectional view similar to Figure 8 but of a piston element having a first modified flange;

**[0026]** Figure 24 is a cross-sectional view similar to Figure 8 but of a piston element having a second modified flange;

**[0027]** Figure 25 is a cross-sectional view similar to Figure 8 but of a piston element having a third modified flange;

**[0028]** Figure 26 is a pictorial view similar to Figure 7 but of a modified piston element;

**[0029]** Figure 27 is a pictorial view similar to Figure 20 but with a piston element as shown in Figure 26;

**[0030]** Figure 28 is a partial cross-sectional view along section line A-A' in Figure 27;

**[0031]** Figure 29 is a partial cross-sectional view similar to Figure 28 but with the piston element in a different position;

- [0032] Figure 30 is a partially cross-sectioned schematic view showing a flange of a piston element as in the embodiment of Figures 19 to 22;
- [0033] Figure 31 is a bottom view of a modified flange of a piston element;
- [0034] Figure 32 is an annular cross-sectional view along section line B-B' in Figure 31.

#### Detailed Description of the Drawings

[0035] Reference is made first to Figure 1 which shows a dispenser 10 in accordance with a preferred embodiment of the invention. The dispenser 10 comprises a reservoir 12, and a housing 14.

[0036] The reservoir 12 comprises a chamber 16 for holding fluid 18 as, for example, an aqueous alcohol solution which is to be dispensed. An outlet 20 is provided through a lowermost wall 17 of the chamber 16, across which is located a valve assembly 22 to regulate the flow of fluid 18 outwardly therethrough. Preferably, the reservoir 12 is made entirely of plastic and is disposable once the supply of fluid 18 is exhausted.

[0037] Figure 1 shows the housing 14 in an open configuration, ready for insertion of the reservoir 12. The housing 14 includes a cover 24 which is hingedly connected to a backplate 26 adapted for permanent attachment to a wall by screws 8 or other known means. The cover 24 pivots relative to the backplate 26 about hinge pivot 25 in a known manner from the open position, which permits removal and replacement of the reservoir 12 in the direction of arrow 4 to a closed position wherein the dispenser may be used to dispense fluid 18. With the cover 24 open to the piston shown in Figure 1, the reservoir 12 is inserted into the housing 14 with the outlet 20 oriented upwardly. The movement of the cover 24 to the closed position inverts the reservoir 12 so that the outlet 20 is reoriented downwards ready to dispense fluid 18.

[0038] The cover 24 is formed having a generally box-like shape so as to define a reservoir cavity 28 in which the reservoir 12 is housed. With the reservoir 12 inserted in the cavity 28, the cover 24 is closed moving the reservoir 12 to a dispensing position wherein the fluid 18 may be dispensed outwardly via the opening 20 and valve assembly 22. An actuator

assembly 30 is provided in the housing 14, movable relative to the cover 24 to activate a movable piston element 78 of the valve assembly 22 and effect fluid 18 dispensation.

**[0039]** With the piston element 78 in a coupled orientation relative to the actuator assembly 30 to dispense fluid, the piston element 78 is reciprocated between an extended position shown in Figure 2 and a retracted position shown in Figure 3.

**[0040]** The actuator assembly 30 includes a lever 32 which is pivotally connected to the cover 24, and a catch assembly 34. The catch assembly 34 is adapted for engaging and securing part of the piston element 78 thereto. The lever 32 pivots in the direction of arrow 6 in Figure 1 about the axis of a metal rod 33 which extends across the cover 24. One end of the lever 32 abuttingly contacts the catch assembly 34 such that pivotal movement of the lever 32 moves the catch assembly 34 between an extended position spaced from the reservoir 12 as seen in Figure 2, and a retracted position wherein the catch assembly 34 is moved toward the reservoir 12 as seen in Figure 3.

**[0041]** As will be described in greater detail hereafter, the actuator assembly 30 permits the horizontal sliding insertion of the reciprocally movable piston element 78 into the catch assembly 34 either into an orientation where the catch assembly 34 and piston element 78 are coupled for movement together, as shown in Figures 2 and 3, or an uncoupled orientation where the catch assembly 34 may move independently from the piston element 78, as shown in Figures 4 and 5.

**[0042]** In the coupled orientation, the pivotal movement of the lever 32 axially moves the catch assembly 34 and piston element 78 between the extended position and the retracted position to dispense a quantity of fluid 18. If the reservoir 12 is inserted with the piston element 78 in the uncoupled orientation of Figures 4 and 5, in a manner later described, the first movement of the lever 32 moves the catch assembly 34 relative to the piston element 78 until the catch assembly 34 engages the piston element 78 and assumes the coupled orientation of Figure 2. In this manner, the dispenser 10 is operative to dispense fluid 18 regardless of whether the piston element 78 is initially inserted into the housing 14 to be either in the coupled or uncoupled orientation to the catch assembly 34.

**[0043]** As best seen in Figure 1, the catch assembly 34 includes a stop shoulder member 36 having a tabular surface 38 which is oriented towards the chamber 16 when the reservoir 12 is inserted. A pair of substantially parallel spaced metal fingers 40, 42 extend from the tabular surface 38 towards the chamber 16, the fingers 40, 42 substantially defining the lateral extent of a cavity or horizontal slotway 43 therebetween. Each finger 40, 42 comprises a flattened ribbon of metal, formed so that a first endmost portion 44, 46 of each respective finger 40, 42 which is remote from the stop shoulder member 36 is resiliently deformable from an unbiased position, wherein the fingers 40, 42 assume their substantially parallel configuration to a biased position, wherein the endmost portions 44, 46 are moved apart. As seen in Figure 2, the fingers 40, 42 extend parallel the axis 79. The slotway 43, best seen in Figures 1 and 10, extends normal to axis 79 about a central slotway centreline 100 shown in Figure 10 which is radial to axis 79. Referring to Figure 10, each finger 40, 42 has interior side surfaces generally indicated 39, 41 in Figure 10 directed into the slotway 43 on each side thereof towards the interior side surface of the other finger so as to define the slotway therebetween. Each finger 40, 42 also has an edge side surface 124, 126 bordering an entranceway to the slotway 43 and extending away from the entranceway.

**[0044]** As shown in Figure 2, finger endmost portion 44 includes an integrally formed projecting tab 48 and finger endmost portion 46 including integrally formed projecting tab 50. The tabs 48, 50 are generally located along each respective finger 40, 42, an equal distance from the tabular surface 38. Each of the tabs 48, 50 projects inwardly into the slotway 43 towards the other, extending angularly downward from the associated fingers 40, 42 towards the tabular surface 38. In this manner, tab 48 extends from endmost portion 44 so as to define thereon a leading side 52a which forms an obtuse angle with a remainder of the finger 40 and a trailing lowermost edge 52b. Similarly, tab 50 extends from endmost portion 46 so as to define thereon a leading side 54a which forms an obtuse angle with a remainder of finger 42 and trailing lowermost edge 54b.

**[0045]** In the embodiment shown, a second endmost portion 56, 58 of each respective finger 40, 42 is secured to the shoulder member 36 as, for example, by snap fitting in complimentary slots 56', 56" and 58', 58" formed therethrough. A generally U-shaped

passage 60 is formed through the shoulder member 36 between second endmost portions 56 and 58. Passage 60 is adapted to permit the exit tube 83 of the piston 78 to slide horizontally therein on insertion or removal of the reservoir 12. As shown in Figure 1, the passage 60 extends from a side 62 of shoulder member 36, a distance into the tabular surface 38.

**[0046]** A generally U-shaped web 66 is provided extending across the cavity 28. The U-shaped web 66 is positioned to permit the reservoir 12 to be slid horizontally inward into the housing 14 for insertion in the manner illustrated in Figure 1. The web 66 is located such that when the reservoir 12 is slid into the housing 14, the web 66 abuts and supports the wall 17 of fluid chamber 16 to assist in maintaining the reservoir 12 in fluid dispensing position. Web 66 also engages a shoulder 23 of the valve assembly 22 such that the web 66 is sandwiched between the wall 17 and the valve assembly 22, thereby preventing axial sliding movement of the reservoir 12 as the dispenser 10 is used. The U-shape of the web 66 further advantageously assists in guiding the reservoir 12 as it is slidably inserted into and removed from the housing 14.

**[0047]** Two parallel spaced locating rods 64a, 64b are secured at a first end to the web 66. At a second end, each locating rod 64a, 64b extends through respective openings 68a, 68b formed through the shoulder member 36. A retaining ferrule 70a, 70b secured about the second end of each rod 64a, 64b respectively prevents the complete withdrawal of the locating rods 64a, 64b from the shoulder member 36. In this manner, the catch assembly 34 is guided in sliding movement along the rods 64a, 64b, between the first rest position shown in Figure 2, wherein the shoulder member 36 abuts against ferrules 70a, 70b, and the second fully inserted position wherein the shoulder member 36 and fingers 40, 42 are moved along rods 64a, 64b a distance towards the web 66.

**[0048]** Springs 72a, 72b are provided about each of the locating rods 64a, 64b respectively. The springs 72a, 72b are sized to engage both the web 66 and the shoulder member 36 to resiliently bias the catch assembly 34 to the first rest position shown in Figure 2. As is to be appreciated, pivotal movement of the lever 32 in the direction of the arrow 6 shown in Figure 1 moves the end portion thereof against the shoulder member 36 to overcome the force of the springs 72a, 72b, moving the catch assembly 34 from the extended

position to the retracted position. On release of the lever 32, the force of the springs 72a, 72b returns the catch assembly 34 to the extended position.

**[0049]** Figures 2 and 3 show the reservoir valve assembly 22 as comprising a dispensing chamber 74 having at an inwardmost end thereof, a one-way valve 76 which permits fluid 18 to flow outwardly only from the chamber 16 into the dispensing chamber 74. The reciprocally movable piston element 78 is slidably received within the dispensing chamber 74 along axis 79 and rotatable relative the dispensing chamber 74 about the axis 79. Reciprocal movement of the piston element 78 causes fluid 18 to flow from the chamber 16 outwardly past the one-way valve 76 and via passage 82 inside exit tube 83 to exit out a nozzle 81 at an outermost end 80 of the piston element 78. The nozzle 81 restricts flow so as to develop a pressure drop across the nozzle 81 which creates a spray. The nozzle 81 is only schematically shown in cross-section in Figure 2 and will, preferably, have a known construction for providing a spray. As best seen in Figure 6, the nozzle 81 has an exit opening which is an elongate rectangle and will direct a frustoconical spray which is wide as measured in a direction of the longer side of the rectangle and relatively narrow as measured in a direction of the shorter side of the rectangle. The nozzle 81 is fixedly secured to the piston element 78 against relative rotation. The nozzle sprays the fluid being dispensed, preferably as an atomized spray, in a predetermined spray pattern orientated relative the axis 79 depending upon the relative rotational position of the piston element 78. The spray pattern may comprise a preferred frustoconical pattern as, for example, in a cone of rectangular cross-section to prevent the spray as, for example, being directed rearwardly onto the wall on which back plate 26 of the dispenser is supported by having the rectangle of the nozzle 81 disposed with the longer side of its rectangle disposed to be parallel to the wall. When the piston element 78 is in desired rotational positions relative the axis 79, the nozzle 81 directs fluid over desired angular sectors relative the housing and when the piston element 78 is in undesired rotational positions relative the axis 99, the nozzle directs fluid over undesired angular sectors relative the housing.

**[0050]** The piston element 78 is rotatable relative the dispensing chamber 74 about the axis 79 and, preferably, is to be placed in the desired rotational position in which the nozzle

81 directs its spray over a preferred sector relative the axis 79. The piston element 78 carries a radially extending flange 86 which provides engagement surfaces by which the piston element 78 is engaged by the actuator assembly 30 and actuated in reciprocal sliding movement to dispense fluid 18.

**[0051]** As best seen in Figure 7, the piston element 78 carries four guide vanes 85 which extend radially outwardly from the exit tube 83 on an inner side of the flange 86. The guide flanges 85 assist in coaxially locating the piston element 78 in the dispensing chamber 74 and in permitting relative rotation of the piston element 78 coaxially within the chamber 74.

**[0052]** The flange 86 is configured so as to interact with the actuator assembly 30 and have the piston element 78 assume the desired rotational position. In this regard, the actuator assembly 30 includes the catch assembly 34 carrying the pair of spaced resilient metal fingers 40 and 42 which are to receive the flange 86 therebetween.

**[0053]** Reference is made to Figures 7 and 8 which best show the preferred configuration of the flange 86. Figure 8 is limited to showing the piston 78 pictorially as cross-sectioned along section line 8-8' in Figure 7. Figure 7 best shows the exit tube 83 carrying the passageway 82 and the four vanes 85 about the exit tube 83 which serve to assist in locating the piston 78 coaxial to the axis in the cylindrical dispensing chamber 74.

**[0054]** The flange 86 is configured such that it can be divided into halves about any plane through the axis 79 normal to the axis 79 with each half to be identical to the other but rotated 180° from each other. To state this in other terms, the external profile of the flange 86 repeats itself every 180° of rotation about axis 79.

**[0055]** Figure 8 shows one such plane indicated as dotted line 98 normal axis 79 and through axis 79 which divides the flange 86 into a first left half 101 and a second right half 102.

**[0056]** Each half 101, 102 has an arm-like protrusion 103, 104 presenting a planar shoulder surface 105, 106 such that the shoulder surface 105, 106 is each directed in the same clockwise rotational direction. A back surface 107, 108 of each half 101, 102 joins an outer edge 109, 110 of its shoulder surface 105, 106 with an inner edge 112, 111 of the shoulder surface 106, 105 of the other half 102, 101.

**[0057]** Each back surface 107, 108, preferably, has a flat planar middle segment 113, 114 such that the middle segments 113 and 114 are diametrically opposite from each other and each centered relative the axis 79 about a diametric plane indicated by dashed line 99 as parallel surfaces spaced a width W. Each middle flat segment 113, 114 have outer edges 115, 116 and inner edges 117, 118. Each edge 115, 116, 117 and 118 of the flat segments 113, 114 is located at a radius R from the axis 79.

**[0058]** The back surfaces 107, 108 curve from outer edge 109, 110 of the shoulder surfaces 105, 106 to the outer edge 115, 116 of the middle flat segments 113, 114 with the radius of the curve not less than the radius R and preferably greatest nearer the outer edges 109, 110 of the shoulder surfaces 105, 106 and reducing to become R at the outer edges 115, 116 of the middle flat segments. Similarly, the back surfaces 107, 108 curve from inner edges 112, 111 of the shoulder surfaces 106, 105 to the inner edges 117, 118 of the middle flat segments 113, 114 with the radius of the curve not less than the radius R and preferably greater nearer the inner edges 112, 111 of the shoulder surfaces and reducing to become R at the inner edges 117, 118 of the middle flat segments 113, 114.

**[0059]** The diametric width of the flange 86 is the width measured in any line passing through the axis 79. The diametric width is the smallest from point 119 to point 120 on diametric plane 99 where it equals W.

**[0060]** The diametric width increases as the point at which the diametric width is measured moves from the diametric plane 99 toward either outer edge 109, 110 of the shoulder surfaces. As a result, when the flange 86 is received between the fingers 40, 42 and biases the fingers apart, the bias of the fingers to move towards each other will have a camming effect which tends to rotate the flange 86 to a position in which the fingers 40, 42 are spaced the least distance apart, that is, engaging on the flat middle segments 113, 114.

**[0061]** The flange is advantageously sized having a radial dimension larger than the remainder of the piston element 78 so as to engage an endmost surface 75 of the dispensing chamber 74 to limit its inward sliding movement therein.

**[0062]** On insertion and replacement of the reservoir 12, the cover 24 is moved to the open position shown in Figure 1. The reservoir 12 is aligned horizontally forward of the

reservoir cavity 28 with the outlet 20 upward and the axis 79 orientated at a desired predetermined angulation relative the vertical, in the case of Figure 1, vertical. In such angulation, the reservoir 12 is slid horizontally rearwardly relative to the housing 14, into the housing 14 such that the wall 17 of the reservoir is positioned abutting the U-shaped web 66, with the web 66 sandwiched between part of the lower wall 17 and a shoulder 23 of the valve assembly 22. As the reservoir 12 is slid horizontally rearwardly into the housing 14, the flange 86 slides radially into a slotway 83 defined intermediate the resilient fingers 40, 42. The flange 86 biases the fingers 40, 42 apart and the outermost end 80 of the piston element 78 moves into the U-shaped fluid passage 60. The reservoir 12 is preferably adapted to be slid into the housing linearly normal the axis 79, however, the reservoir could slide at a different angle than normal or along a non-linear or arcuate path.

**[0063]** The interaction of the flange 86 with the fingers 40, 42 will vary depending upon the relative rotational position of the piston element 78 and the relative axial position of the piston element 78. A new replacement reservoir preferably carries the piston element 78 in the fully retracted position such that, on insertion, the piston element 78 slides horizontally to assume a relative position, referred to later as the third orientation, to the actuator assembly 30 and its fingers 40, 42 as seen in Figure 5.

#### Rotation

**[0064]** Rotation of the piston element 78 on horizontal sliding insertion of the reservoir is now discussed with reference to Figures 9 to 16 which are intended to show the piston element in the preferred third orientation axially relative the housing during horizontal sliding insertion.

**[0065]** Figure 9 is a partial cross-sectional view along section line 9-9' in Figure 5 showing the piston element 78 as fully inserted horizontally between the fingers 40, 42 and with the piston element 78 in a desired rotational position with the diametric line 99 normal to the a vertical medial line 100 of the slotway 43 defined between the fingers 40, 42.

**[0066]** In Figure 9, the fingers 40, 42 engage on and are each centered on the flat middle segments 113, 114 of the flange 86.

**[0067]** Reference is made to Figure 10 which is similar to Figure 9 but shows the relative positioning of the piston element 78 at the entranceway to the slotway 43 forward of the fingers 40, 42 and ready to be moved horizontally rearwardly during insertion with the axis 79 to advance along the medial plane 100 of the slotway 43 in the direction of the arrow to assume the position of Figure 9. In Figure 10, the fingers 40, 42 are in unbiased positions spaced a distance which is less than W. On sliding the piston element 78 rearwardly, the curved surface of the flange 84 engages on the finger 42 and later on finger 40 to bias the fingers 40, 42 away from each other to the relative position shown in Figure 9. The relative position of the fingers 40, 42 on the flange 84 in Figure 9 is shown in dashed lines in Figure 10.

**[0068]** In such horizontal insertion, as shown in Figure 10, there is substantially no tendency of the piston element 78 to rotate relative the fingers 40, 42 from the desired rotational position with the diametric line 99 normal the slotway medial plane 100. The piston element 78, at all times in insertion from the position of Figure 10 to the position of Figure 9, is in a desired rotational position relative the axis 79 and the housing with the diametric line normal the medial line 100 of the slotway 43.

**[0069]** Reference is made to Figures 11, 12 and 13.

**[0070]** Figure 11 is similar to Figure 10 but with the piston element 78 in an undesired rotational position relative the housing about the axis 79 being rotated 45° clockwise relative the position in Figure 10 and, in this position, is slid forwardly so that the flange 86 enters the entranceway to the slotway 43 and first contacts one of the fingers 40, 42.

**[0071]** Figure 12 illustrates relative positioning of the flanges 86 and fingers 40, 42 after the piston element 78 has been slid horizontally rearwardly from the position of Figure 11 showing that the flange 86 has forced the fingers 40, 42 apart.

**[0072]** Figure 13 illustrates a position similar to Figure 9, to which the piston element 78 moves on further horizontal rearward sliding from the position of Figure 12. With rearward movement of the reservoir 12 with the piston element 78 free to rotate relative the reservoir 12, the bias of the fingers 40, 42 will tend to rotate the flange 86 counterclockwise from a position with the fingers 40, 42 more widely spread in Figure 12 to the position with the

fingers 40, 42 less widely spread in Figure 13. In the progression of insertion, the piston element 78 is rotated from the undesired rotational position of Figure 11 to the desired rotational position of Figure 13 with the diametric line 99 normal the medial line 100.

[0073] Figure 14 is similar to Figure 10 but with the piston element 78 in the undesired rotational position about axis 79 relative the housing rotated 45° counterclockwise relative the position in Figure 10 and in that position slid forwardly that the flange 86 first contacts one of the fingers 40, 42. With further movement forwardly, the flange 86 will move the fingers 40, 42 outwardly and the bias of the fingers 40, 42 will tend to rotate the piston element clockwise towards the desired position shown in Figure 9.

[0074] Figure 15 is similar to Figure 10 but with the piston element 78 in the undesired angular orientation relative the axis rotated relative the position in Figure 10, either clockwise or counterclockwise, and in a position that the left hand side shoulder, shoulder 103, as seen in Figure 15, engages a forwardly directed surface 124 of the left-hand side finger 42. With further forward sliding of the piston element 78, the piston element 78 rotates by reason of the surface 124 preventing forward movement of the shoulder 103. With further forward sliding to the position shown in Figure 16 of the piston element 78, the engagement of the surface 124 with the shoulder 103 and the bias of the spread apart fingers 40, 42 tend to rotate the piston element counterclockwise to the desired position of Figure 9.

[0075] In Figure 10, the two fingers 40 and 42 are shown in an unbiased position in which they are spaced a distance indicated W. The slotway 43 is defined between the fingers 40 and 42 which slotway 43 extends in a direction indicated by slotway medial plane 100.

#### Axial

[0076] When the reservoir 12 inserted in the housing 14, the radially extending flange 86 will assume one of three axially displaced orientations shown best in Figures 2, 4 and 5.

[0077] In a first axial orientation shown in Figure 2, the catch assembly 34 and the piston element 78 are coupled to each other with the radially extending flange 86 fully in a first zone 88 (shown for clarity in Figure 3). The first zone 88 is the area of the slotway 43 between the fingers 40, 42 that is delineated at an upper extent by the trailing edges 52b, 54b of each respective tab 48, 50 and at a lower extent by the tabular surface 38.

**[0078]** In the first axial orientation, the movement of the actuator assembly 30 moves the radially extending flange 86 therewith. As is to be appreciated, the housing 14 and reservoir 12 are preferably configured so that when the actuator assembly 30 is in the extended position and is coupled to the radially extending flange 86, the piston element 78 is in an optimum extended position relative to the dispensing chamber 74.

**[0079]** To dispense fluid 18, the actuator assembly 30 is cycled by the pivotal movement of the lever 32 moving the catch assembly 34 from the extended position to the retracted position shown in Figure 3, and then the springs 72 returning the catch assembly 34 back to the extended position. As the shoulder member 36 moves from the extended position to the retracted position, the tabular surface 38 engages the lower flange surface 92. As best seen in Figure 3, the engagement of the tabular surface 38 with the lower flange surface 92, slides the piston element 78 inward in a first direction relative to the dispensing chamber 74. The piston element 78 moves inward into the dispensing chamber 74 until the upper flange surface 94 abuttingly engages the endmost surface 75 to limit further movement of both the piston element 78 and actuator assembly 30.

**[0080]** On release of the lever 32, the catch assembly 34 is returned to the extended position under the force of springs 72a, 72b to complete the cycle. As is to be appreciated, on return movement of the catch assembly 36 under the force of springs 72a, 72b, the trailing edge 52b, 54b of each tab 48, 50 moves into engagement with the upper flange surface 94, to slide the piston element 78 in a second direction outward from the dispensing chamber 74.

**[0081]** The reservoir 12 may also be inserted into the housing 14 with the piston element 78 in a second or third axial orientation. In the second axial orientation seen in Figure 4, the catch assembly 34 and piston element 78 are uncoupled with the radially extending flange 86 partially in the first zone 88 and partially in a second zone 90. As best seen in Figure 5, the second zone 90 is generally the area of the slot 43 delineated at a lower extent by the leading sides 52a, 54a of each tab 48, 50 and at an upper extent by the endmost surface 75 of dispensing chamber 74.

**[0082]** In the third axial orientation shown best in Figure 5, the catch assembly 34 and piston element 78 are uncoupled with the radially extending flange 86 fully in the second zone 90.

**[0083]** If on sliding insertion of the reservoir 12 into the housing 14 the radially extending flange 86 assumes either the second or third uncoupled axial orientation, on first cycling of the actuator assembly 30, the catch assembly 34 moves relative to the flange 86 to achieve the first coupled axial orientation.

**[0084]** With the engagement flange 86 in the uncoupled axial orientation, either wholly or partially in the second zone 90 as shown in Figures 4 or 5, the initial movement of the catch assembly 34 from the first position moves the leading side 52a, 54a of each of tab 48 and tab 50 into contact with the lower flange surface 92. As the fingers 40, 42 move towards the web 66, the leading sides 52a and 54a act as camming surfaces, deflecting the endmost portions 44 and 46 of each associated finger 40 and 42 from the unbiased position, radially outwardly to the biased position. As is to be appreciated, the end portions 44, 46 are deflected a sufficient distance to permit movement of projecting tabs 48 and 50 axially past the radially extending flange 86.

**[0085]** Once the tabs 48, 50 move relative to the piston element 78 so that each respective trailing edge 52b, 54b is positioned between the upper flange surface 94 and the chamber 16, the resiliency of the fingers 40, 42 causes the return of endmost portions 44, 46 to the unbiased position. On the return to the unbiased position, the trailing edges 52b, 54b are moved to a position to overlap and abuttingly engage a peripheral portion of the flange surface 94. The engagement of the trailing edge 52b, 54b with the flange surface 94 prevents return axial movement of the radially extending flange 86 past the projecting tabs 48, 50 effectively coupling the flange 86 to the catch assembly 34 between the tabs 48, 50 and the tabular surface 38.

**[0086]** The spacing between the tabs 48, 50 and tabular surface 38, is selected to permit the insertion of the radially extending flange 86, fully within first zone 88. The tabular surface 38 and fluid passage 60 are further selected such that when the radially extending

flange 86 is in the first, coupled axial orientation with the catch assembly 34, a portion of the tabular surface 38 abuts a portion of the lower flange surface 92.

#### Rotation/Axial

**[0087]** New replacement reservoirs preferably carry the piston element 78 in the fully retracted position and, when inserted, assume the third axial orientation. With first cycling of the piston element 78, the piston element 78 is moved relative the fingers 40, 42 to the first, coupled axial orientation with deflection and changes in the extent the fingers 40, 42 are biased apart. Such change of the position of the fingers 40, 42 causes relative movement between the fingers 40, 42 and flange 66 which increases the tendency of the piston element 78 to rotate toward the desired angular orientation shown in Figure 9.

**[0088]** The dispenser 10 of the present invention, advantageously permits insertion of the reservoir 12 into the housing without the requirement of ensuring the piston element 78 is in a particular axial or rotational position relative the catch assembly 30.

**[0089]** As is to be appreciated, with the radially extending flange 86 in the first coupled axial orientation, cycling of the actuator assembly 30 causes the axial inward and outward movement of the piston element 78 in the dispensing chamber 74 to dispense fluids 18. On activation of the dispenser 10, fluid 18 flows from the chamber 16 outwardly through the passage 82 to the nozzle 81. Once the supply of fluid 18, in the chamber 16 is exhausted, the reservoir 12 may be removed for replacement by again moving the cover 24 to the open configuration shown in Figure 1, and radially sliding the reservoir 12 outwardly in a direction transverse to the direction of axial movement in the reverse manner as insertion.

**[0090]** Although not essential, providing a passage 60 having a U-shape and extending into a side 62 of the shoulder member 36 is advantageous as it simplifies insertion of the reservoir 12 into the housing 14. Specifically, the engagement of the outermost end 80 of the piston element 78 against the edge of the fluid passage 60 may be advantageously used to assist in guiding placement of the reservoir 12 in the correct axial alignment in the actuator assembly 30.

**[0091]** Reference is made to Figures 17 to 22 which illustrate a second embodiment of a dispenser in accordance with the present invention. The dispenser of Figures 17 to 22

operates in a very similar manner to that described with reference to Figures 1 to 16, however, with the reservoir 12 adapted to be moved vertically down into the housing 10 and then moved, while in a vertical position, rearwardly. The reservoir 12 carries a valve assembly 22 with a piston element 78 identical to that described with reference to Figures 1 to 16.

**[0092]** The actuator assembly 30, as best seen in Figure 19, is adapted for pivoting relative to the housing 10 on stub axles 200 biased downwardly by springs (not shown) to be engaged on spring stubs 202 with an upper end of the springs to engage on the underside of the web 66 provided in the housing. The actuator assembly 30 has a hand lever 32 adapted to be manually engaged by a user and urged towards a wall supporting the housing to dispense fluid.

**[0093]** As best seen in top view in Figure 19, the actuator has metal fingers 40, 42 substantially identical to those in the embodiment of Figure 1 defining a horizontal slotway 43 therebetween. A passage 60 is formed below the fingers between the fingers 40, 42 through which the exit tube 83 of the piston element 78 is to extend as seen in Figures 18 and 20 to 22.

**[0094]** While only shown in Figure 17, the housing 10 carries a web 66 substantially similar to the web 66 in Figure 6 which is to receive the neck of the reservoir as between the wall 17 and the valve assembly 22.

**[0095]** Figure 18 illustrates as 204 the angular sector over which the nozzle 81 directs fluid when the piston element 78 is in a desired rotational position with a long side of a rectangle of the nozzle 81 parallel to the lever 32. Figure 18 illustrates in broken lines the undesired angular sector 206 over which the nozzle 81 would direct fluid if the nozzle 21 is orientated in an undesired rotational position 90° from the desired rotational position shown in solid lines. As seen, the undesired angular sector 206 results in the spray impacting on the rear side of the lever 32 on its inward pivoting, as would be disadvantageous.

**[0096]** Figure 20 illustrates in pictorial view with the second embodiment, the piston element 78 as being inserted and in the position substantially identical to that illustrated in Figure 15 with the first embodiment. In insertion, the piston element 78 is being slid

horizontally rearwardly and the shoulder 103 of the flange 86 becomes engaged with the forwardly directed surface 124 of the finger 42. From the position of Figure 20, with further rearward sliding of the piston element 78, piston element 78 becomes rotated about its axis 79 and rotates counterclockwise in assuming the position of Figure 21 which effectively corresponds to the position shown in Figure 16 and, subsequently, towards the position shown in Figure 22. From the position shown in Figure 22, with further movement of the piston 78 as, for example, in axial movement of the piston, the bias of the fingers 40, 42 on the cam surfaces of the flange 86 will tend to rotate the piston element 78 to its desired angular position.

**[0097]** Reference is made to Figure 23 which shows a cross-sectional view through the flange 86 of an alternate piston element 78 showing a different configuration for the flange. The flange 86 in Figure 23 is illustrated as being of a racetrack shape with parallel flat center portions 113 and 115 having at either end semi-circular portions 220 and 222 of a radius equal to the width between the flat portions 113 and 115 and each centered on axis 221 and 223 which are equally spaced from axis 79. The axis 79 of the piston element is shown as centered in the middle of the flat sections 113 and 115. The embodiment of Figure 23, therefore, has similarities to the embodiment in Figure 8, however, without the shoulder-forming arms 103 and 104 at each end.

**[0098]** Reference is made to Figure 24 which illustrates a cross-sectional view of an alternate form of the flange 86 which has an exterior shape identical to that in Figure 23, however, has the opening 82 and the axis 79 of the piston displaced towards one end that is closer to axis 221 than axis 223. In the embodiment of Figure 24, having the axis 79 asymmetrically placed can be of assistance in initiating rotation as in the case where the piston element 78 is inserted 90° from the desired rotational orientation.

**[0099]** Reference is made to Figure 25 which is identical to the embodiment of Figure 24, however, the lower semi-circular portion in Figure 24 is replaced by a wedge-shaped portion with flat surfaces 224, 225 merging at apex 226.

**[0100]** With the embodiments illustrated in Figures 23 to 25, the forces of the fingers 40, 42 acting on the circumferential surfaces of the flange 86 will end to rotate the piston element to the desired rotational position.

**[0101]** In the embodiments illustrated in Figures 1 to 24, the camming interaction which is to rotate the piston element 78 to desired rotational orientation on insertion is a camming interaction between radially outwardly directed surfaces of the flange 86 and the fingers 40 and 42. This is not necessary and the camming action may be developed by the interaction of other surfaces.

**[0102]** Reference is made to Figure 26 which is a view of a piston element 78 similar to that in Figure 7, however, illustrating a piston with a circular flange 86 and with a cam arm 230 fixedly secured to the exit tube 83.

**[0103]** Figure 27 is a pictorial view similar to Figure 20 but showing the piston element 78 of Figure 26 inserted with the piston element disposed rotated 45° from a preferred desired orientation. The piston element 78, on insertion, is disposed at a height such that the cam arm 230 engages one of two vertical, forwardly disposed exterior shoulder surfaces 232, 233 on each side of the passage 60. As is to be appreciated, with further rearward movement of the piston element 78, the cam arm 230 will engage one of the interior shoulder surfaces 232, 233 and will cam the piston element 78 to rotate towards the desired rotational position. Of course, with further inward movement of the piston element 78, the cam arm will come to engage interior shoulder surfaces 234, 235 of the passage 60 in Figures 28 and 19 defining the channel 60.

**[0104]** Figure 28 illustrates a cross-sectional view through plane A-A' in Figure 28 showing the piston element firstly in solid lines as in Figure 27 with the cam arm 230 engaged on the exterior shoulder surface 232 and in dashed lines in a position which the exit tube 83 and cam arm 230 will adopt when slid horizontally rearwardly to be fully inserted and the nozzle 81 is in the desired rotational orientation. In the position shown in solid lines in Figure 28, the cam arm 230 comes to engage the exterior shoulder surface 232 so as to cam the cam arm 230 to rotate to point forwardly.

**[0105]** Reference is made to Figure 29 which shows a cross-sectional view similar to that in Figure 28 but with the piston element 78 in rotational position that the center point 240 and cam arm 230 initially engages between the interior shoulder surfaces 234 and 235 as shown in solid lines and with rearwardly movement comes to adopt the position shown in dashed lines with the cam arm 230 pointed rearwardly and with the nozzle 81 rotated to the desired angular orientation.

**[0106]** It is to be appreciated that when a center point 240 of the cam arm 230 is disposed to extend into the slot 60 between the interior shoulder surfaces 234 and 235, as in Figure 29, then the piston element will become disposed with the cam arm pointing rearwardly. However, when the center point 240 of the cam arm 230 is disposed to engage the outer shoulder surfaces 232, 233 then, with insertion, in the final position, the cam arm 230 will come to extend forwardly from the piston element.

**[0107]** In the embodiments of Figures 26 to 28, the flange 26 may be circular and the interaction of the cam arm 230 alone may be relied for rotation. Alternatively, the flange 86 may be oval and have, for example, a suitable orientation as shown in either Figures 23, 24 or 25 and, in combination, the interaction of both the camming of the flange 86 and the cam arm can assist in relative rotation of the piston element 78.

**[0108]** In the context of the embodiment illustrated in Figures 26 to 28, the nozzle 21 and the cam arm 230 may be carried on an end portion 242 of the exit tube 83 with such end portion 242 journaled for rotation coaxially about the axis 79 relative to the remainder of the piston element 78. In this case, the piston element 78 may have a circular flange 86 and the end portion 242 of the exit tube 83 carrying the nozzle 82 and the cam arm 230 may independently be rotated to a desired position on insertion of the piston element. However, in another embodiment, the end portion 242 of the exit tube 83 carrying the nozzle may be fixed to the remainder of the piston element 78 such that there is required rotation of the entirety of the piston element 78 or at least the portion of the piston element comprising the flange 86 and the camming arm 81 and the nozzle 81 together in unison.

**[0109]** Reference is made to Figure 19 which shows that upwardly directed arcuate camming surfaces 250, 251 are provided on either side of the channel 60 which arcuate

surface 250 is adapted to engage the downwardly directed lower surface of the flange 86 of the piston element 78. Figure 30 schematically illustrates a side view showing the interior shoulder surface 253 of the channel 60 and the finger 42 engaging a flange 86 in the first axial orientation wherein the flange 86 has planar upper and lower surfaces 92 and 94 as in Figures 3 and 7. Figure 31 illustrates a bottom view of a further embodiment of a piston element 78 identical to that in Figures 3 and 7 with the exception of having a flange 86 which is cylindrical about the axis 79 and with carrying on the downwardly directed lower surface 92 of the flange 86 a raised annular camming ramp 370.

**[0110]** Figure 32 illustrates an annular cross-sectional view along section line B-B' in Figure 31 showing the annular camming ramp 370. When the piston element 78 is inserted to be disposed centered between the fingers 40 and 42 in the desired position, the raised arcuate camming surfaces 250 and 251 engage on the annular camming ramp 270 at diametrically opposed locations and will tend to bias the piston element 78 to rotate to a desired angular orientation in which the overall axial extent of the ramp 370 and the arcuate camming surfaces 250 and 251 are at a minimum.

**[0111]** It is to be appreciated that a piston element 78 could be adopted to assume, for example, the rotating features of each of the embodiments illustrated in Figures 23, 26 and 30 or any combination thereof.

**[0112]** The preferred embodiments are shown having two resiliently deformable ribbons of metal acting as finger members, however, the invention is not so limited. Other apparatus and modes for permitting one way coupling of the actuator assembly 30 to the piston element 78 may also be used, including but not limited to, resiliently deformable flanges or prongs adapted to engage corresponding complimentary slits formed in either of a piston element 78 or the actuator assembly.

**[0113]** While the preferred embodiment of the invention as shown illustrates two resiliently deformable substantially parallel finger members, the invention is not so limited. Other combinations and configurations of finger members may equally be used, and will now be apparent.

**[0114]** Figures 1 to 5 illustrate two straight locating rods 64a, 64b to assist in guiding movement of the actuator assembly 30, however, the invention is not so limited. Other means of guiding movement of the actuator assembly, including curved rods to assist in guiding the shoulder member 36 in arcuate movement may also be used.

Further, the dispenser may be provided with an actuator assembly characterized by a catch assembly which is carried directly by and adapted for arcuate movement with a pump activating lever permit substantially unhindered axial sliding of the piston element 78 as the catch assembly moves along its arcuate path.

**[0115]** Although the invention has been described with reference to preferred embodiments, it is not so limited. Many variations and modifications will now occur to persons skilled in the art. For a definition of the invention, reference may be made to the appended claims.